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CRUISE REPORT[1]

VESSEL: *Oscar Elton Sette*, Cruise OES-05-14 (OES-36)

CRUISE PERIOD: 7–24 November 2005

AREAS OF OPERATION: In and around the lee side of the Island of Hawaii (Kona Coast) to the vicinity of Cross Seamount (Fig. 1)

ITINERARY:

07 Nov Embarked scientists Brill, Curran, Galli, Kikkawa, McCracken, Musyl, Shiels and Shimada. Departed Snug Harbor 1430. Began transit to Kailua-Kona.

08 Nov Embarked scientist Hirschey from the pier at Kailua-Kona at 0900. Scientists Galli, Hirschey, Musyl, and Shiels weighed out numerous chemical solutions while on land (i.e., analytical balance would not "zero out" on ship).

08 Nov Conducted troll fishing operations around "C" buoy (ca. lat. 19º18'N, long. 155º57'W) for most of the day with catch details from trolling reported in Table 1. At around 1900, 465 (18/o circle) hooks were deployed using 110 count sanma (*Cololabis saira*) as bait. The "jumper" part of the droppers (i.e., gangions) were approximately 11 m (6 fm) in length and made from 450 lb. test monofilament and terminated in a loop (ca. 3.5 × 2.5 cm) protected by green chaffing gear. The "leader" part of the dropper was a 30.5-cm (ca. 12 in) section of 49 braid stainless wire terminating with a 18/o circle hook and a loop (ca. 3.5 × 2.5 cm) protected by the same green chaffing gear. Connecting the sections in a "loop-to-loop" arrangement made the "full dropper." Since longline fishing was designed to fish shallow at night, we fished between 7-16 hooks/float. Main line was ca.10 km

[1] PIFSC Cruise Report CR-06-028
Issued 26 November 2008

(approx. 6 miles) in length. Deployment details and catch from longline gear are given in Table 2.

09 Nov Started retrieval of longline gear around 0800 and ended around 1035. At around 1100, continued trolling operations around C buoy and deployed ca. 451 hooks at around 1900.

08-10 Nov Conducted longline, handline, and troll fishing operations. Captured tunas and mahimahi for hearing and cardiac function studies and collected tissue samples for ongoing physiological and sensory experiments. Conducted experiments with dehooking devices on samples deemed for release. See Appendix I for details and results of these studies.

10 Nov Embarked scientists Bass and Clemens from the pier at Kailua-Kona at 0600. Retrieval of longline gear occurred around 0800. Continuous trolling operations around the leeward fish aggregating devices (FADs) off the Big Island (after retrieval of longline gear). Set another 462 hooks at 1900.

11-14 Nov Conducted longline, handline, and troll fishing operations around "Tsunami Buoy" (ca. lat. 19º38'N, long.156º32'W). Captured tunas and mahimahi for hearing and cardiac function studies and collected tissue samples for ongoing physiological and sensory experiments. Conducted experiments with dehooking devices on samples deemed for release. See Appendix I for details and results of these studies.

13 Nov At ca. 1700 disembarked scientists Bass and Clemens at pier in Kailua-Kona.

15 Nov Embarked scientist Domokos from pier at Kailua-Kona at around 1800. Disembarked scientist Hirschey. Transited to Kealakekua Bay to test and calibrate acoustic instrumentation.

16 Nov Calibration test at Kealakekua Bay (see Appendix I for details). Disembarked scientist Domokos and embarked scientist Garsha at 1700. Began transit to Cross Seamount.

17 Nov Transited to Cross Seamount. Retrieved high-frequency acoustic recording package (HARP) oceanographic monitor. Conducted trolling operations and deployed longline gear in the evening. Downloaded data and refurbished HARP buoy.

18 Nov Retrieval of longline gear and successful redeployment of HARP buoy occurred.

18-20 Nov Conducted longline, handline, and troll fishing operations. Captured tunas and mahimahi for hearing and cardiac function studies and collected tissue samples for ongoing physiological and sensory studies. See Appendix I for details and results of these studies.

20 Nov	Started transit to “F” FAD (ca. lat. 19º33’N, long.156º08’W) around 1300. Continuous trolling operations occurred during transit.
21 Nov	Disembarked scientist Garsha at pier in Kailua-Kona at ca. 1800.
22 Nov	Conducted 2 Isaac-Kidd trawls (1 deep (50m) and 1 surface for 1 hr. duration) starting at 2100.
21-23 Nov	Conducted handline and troll fishing operations around F buoy and Tsunami buoy. Captured tunas and mahimahi for hearing and cardiac function studies and collected tissue samples for ongoing physiological and sensory studies. See Appendix I for details and results of these studies.
23 Nov	Transited to Pearl Harbor around 1100. Disembarked scientists Curran, Kikkawa and Musyl at Snug Harbor around 2300. Continued transit to pier Fox 12 at Ford Island.
24 Nov	Arrived Ford Island at 0030. Disembarked remaining scientists. End of cruise.

MISSIONS AND RESULTS:

A. Test an experimental chemical shark repellent and delivery system(s).

The delivery system for the repellent was not operational at the time of the cruise and, therefore, this aspect was postponed to a later date.

B. Capture small tunas for live-on-board cardiac function experiments investigating the limiting effects of changes in temperature with depth on vertical movements and distribution of yellowfin, skipjack, and bigeye tunas.

Took tissue samples from tunas, billfishes, mahimahi, escolar, lancet fish, snake mackerel, barracuda, and blue sharks (Table 2) for ongoing physiological, biochemical, and anatomical studies.

C. Capture small tunas and mahimahi for live-on-board experiments to determine auditory capabilities, the objective of testing the hypothesis that these fishes located fish aggregating devices by the sound produced by these structures and their associated prey fauna.

This cruise demonstrated the ability to capture and maintain live yellowfin tuna in onboard tanks for up to 14–16 hrs. See Appendix I for the full report.

Data, obtained from seven animals, are still being analyzed but preliminary conclusions are that the effective hearing range of juvenile yellowfin is very narrow, extending from only about 300 Hz to 800 Hz. The fish appear to be the most sensitive to sounds in the 400–500 Hz range.

D. Experiment with dehooking devices for the purpose of releasing pelagic sharks and fishes for the Pacific Islands Regional Office.

   The dehooking device was experimented on 33 released sharks. See Appendix I for the full report, but indications suggest it does not work on large circle hooks embedded in the jaws.

E. Retrieve the HARP oceanographic monitor at Cross Seamount and use it for later deployment for Protective Species Division.

   Successfully retrieved, downloaded data, replaced batteries, and redeployed HARP buoy.

F. Conduct calibrations of the Simrad EK60 echosounder for Ecosystems and Oceanography Division.

   Calibrated the Simrad EK60 echosounder (see Appendix I for more details). Kealakekua Bay was chosen as an ideal site for the calibration of the 38kHz and 120kHz EK60 transducers because of its shallow, protected waters with no waves and minimal currents.

G. Capture large spawning-size marlin for attachment of pop-up satellite archival tags (PSATs) for long-term migration studies.

   No spawning sized marlin were captured and therefore no PSATs were deployed.

H. Conduct neustonic trawls to collect larval and egg specimens to confirm billfish spawning in the immediate area.

   Two 1-hour trawls were conducted (deep [50 m] and surface) for outreach samples.

I. Incidentally captured adult tuna and shark species (excluding blue sharks) will also be tagged with PSATs and/or with plastic conventional tags. Place PSATs on sharks and tunas for long-term migration studies.

   Six samples of pelagic fishes were conventionally tagged (Table 3).

NARRATIVE SUMMARY:

A total of eight operational longline sets were conducted during the cruise (Table 2) with catch details by gear provided in Tables 1 and 2. Trolling operations were important in order to catch live fish for physiological experiments. A turtle dehooking device was experimented on released sharks. Three samples of scalloped hammerhead shark, two bigeye thresher sharks and one striped marlin were conventionally tagged (Table 3). Biological samples for ongoing physiological and hearing studies were obtained from select live fish. Narrative reports on the objectives and results from the various cooperative studies are provided in Appendix I.

RECORDS:

The following forms, logs, charts, and data records were kept and given to the Pacific Islands Fisheries Science Center upon termination of the cruise. These include all data captured onto computer storage media during the cruise. All the records are filed there unless indicated otherwise in parentheses.

SEAS system data files
Deck Log-Weather Observation Sheet
Marine Operations Log (NOAA)
Project Area and Operations Chartlets
Station Number and Activity Log
Fish catch record by species, hook number, bait disposition
Data from Temperature Depth Recorders (TDRs)

SCIENTIFIC PERSONNEL:

Colleen Bass, Univ. of Hawaii/Joint Institute for Marine and Atmospheric Research (JIMAR) and Pacific Islands Regional Office (PIRO)
Richard Brill, National Marine Fisheries Service, Northeast Fisheries Science Center
Daniel Curran, National Marine Fisheries Service, Pacific Islands Fisheries Science Center
Anik Clemens, Univ. of Hawaii/JIMAR and PIRO
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Attachments

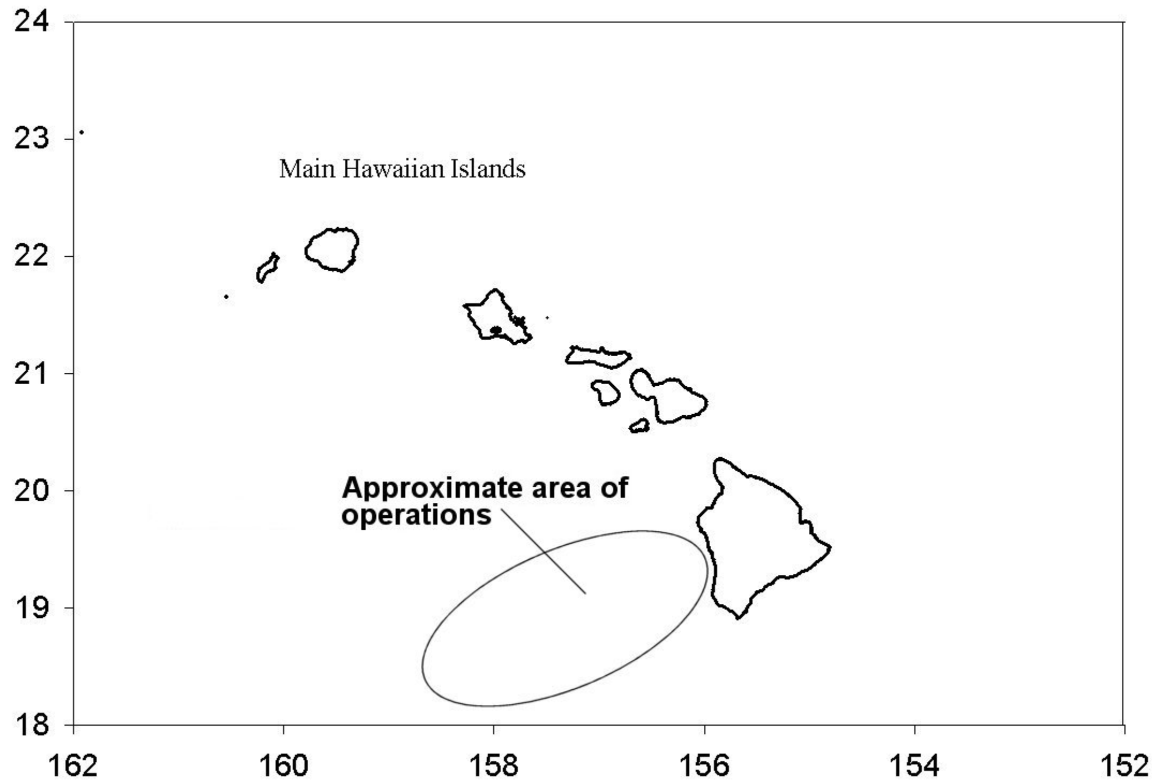

Figure1.--Areas of fishing operation.

Table 1.--Summary of catch details from trolling (TROLL) and longline(LL) operations.

Common Name	Troll	LL	Total
Bigeye thresher shark	0	2	**2**
Bigeye tuna	2	38	**40**
Blue marlin	0	1	**1**
Blue shark	0	41	**41**
Broadbill swordfish	0	3	**3**
Dolphinfish (mahimahi)	9	7	**16**
Escolar	0	1	**1**
Great barracuda	1	2	**3**
Longnose lancetfish	0	1	**1**
Oceanic whitetip shark	0	2	**2**
Scalloped hammerhead	0	4	**4**
Shortfin mako shark	0	2	**2**
Silky shark	0	5	**5**
Silky shark	0	5	**5**
Skipjack tuna (aku)	19	0	**19**
Snake mackerel	0	4	**4**
Striped marlin	0	1	**1**
Wahoo (ono)	2	0	**2**
Yellowfin tuna	33	1	**34**
	66	**120**	**186**

Table 2. Details of longline fishing operations. TDR=temperature-depth-recorder

					Avg TDR		Bait	
Date	**Location**	**Latitude**	**Longitude**	**#Hooks**	**Depth(m)**	**%partial**	**% Full**	**% Empty**
9-Nov	Kona	19 10	156 00	465	42	77	7	18
Species	**Common Name**	**Total Caught**	**Alive/Dead**	**Kept/Released/Tagged**				
Makaira mazara	Blue marlin	1	0/1	1/0/0				
Prionace glauca	Blue shark	10	9/1	9/1/0				
Alepisaurus ferox	Longnose lancetfish	1	0/1	1/0/0				
10-Nov	Kona	19 43	156 10	451	32	79	8	13
Species	**Common Name**	**Total Caught**	**Alive/Dead**	**Kept/Released/Tagged**				
Alopias superciliosus	Bigeye thresher shark	1	1/0	0/0/1				
Prionace glauca	Blue shark	4	4/0	0/4/0				
Xiphias gladius	Broadbill swordfish	1	0/1	1/0/0				
Coryphaena hippurus	Dolphinfish	1	1/0	1/0/0				
Lepidocybium flavobrunneum	Escolar	1	1/0	1/0/0				
Carcharhinus falciformis	Silky shark	2	2/0	0/2/0				
11-Nov	Kona	19 10	155 57	462	41	79	3	18
Species	**Common Name**	**Total Caught**	**Alive/Dead**	**Kept/Released/Tagged**				
Prionace glauca	Blue shark	3	3/0	0/3/0				
Xiphias gladius	Broadbill swordfish	1	0/1	0/1/0				
Coryphaena hippurus	Dolphinfish	2	2/0	2/0/0				
Carcharhinus falciformis	Silky shark	1	1/0	0/1/0				
12-Nov	Jaeger Seamount	19 11	157 00	460	26	64	0	36
Species	**Common Name**	**Total Caught**	**Alive/Dead**	**Kept/Released/Tagged**				
Prionace glauca	Blue shark	6	6/0	0/6/0				
Coryphaena hippurus	Dolphinfish	1	1/0	1/0/0				
Carcharhinus longimanus	Oceanic whitetip shark	1	1/0	0/1/0				
Gempylus serpens	Snake mackerel	1	0/1	1/0/0				
13-Nov	Kona	19 09	156 15	471	60	83	10	7
Species	**Common Name**	**Total Caught**	**Alive/Dead**	**Kept/Released/Tagged**				
Prionace glauca	Blue shark	3	2/1	1/2/0				
Xiphias gladius	Broadbill swordfish	1	0/1	1/0/0				
Carcharhinus longimanus	Oceanic whitetip shark	1	0/1	1/0/0				
Gempylus serpens	Snake mackerel	2	1/1	2/0/0				
17-Nov	Cross seamount	18 43	157 50	583	38	87	1	11
Species	**Common Name**	**Total Caught**	**Alive/Dead**	**Kept/Released/Tagged**				
Thunnus obesus	Bigeye tuna	4	1/3	4/0/0				
Prionace glauca	Blue shark	8	7/1	0/8/0				
Coryphaena hippurus	Dolphinfish	2	2/0	2/0/0				
Sphyraena barracuda	Great barracuda	2	2/0	1/1/0				
Isurus oxyrinchus	Shortfin mako shark	1	0/1	1/0/0				
18-Nov	Cross seamount	18 40	158 19	564	70	84	8	8
Species	**Common Name**	**Total Caught**	**Alive/Dead**	**Kept/Released/Tagged**				
Thunnus obesus	Bigeye tuna	4	2/2	4/0/0				
Prionace glauca	Blue shark	3	3/0	0/3/0				
Isurus oxyrinchus	Shortfin mako shark	1	1/0	0/1/0				
Carcharhinus falciformis	Silky shark	2	2/0	0/2/0				
Tetrapturus audax	Striped marlin	1	1/0	0/0/1				
19-Nov	Cross seamount	18 43	158 17	559	47	84	2	14
Species	**Common Name**	**Total Caught**	**Alive/Dead**	**Kept/Released/Tagged**				
Thunnus obesus	Bigeye tuna	30	14/16	26/4/0				
Prionace glauca	Blue shark	4	4/0	0/4/0				
Coryphaena hippurus	Dolphinfish	1	1/0	0/1/0				
Carcharhinus longimanus	Oceanic whitetip shark	1	1/0	0/1/0				
Sphyrna lewini	Scalloped hammerhead	4	4/0	0/1/3				
Thunnus albacares	Yellowfin tuna	1	0/1	1/0/0				

Table 3.--Species tagged with conventional tags.

Dart tag no.	Date dep.	SPECIES	Gear	Lat.Dec.	Lon. Dec.
HL1104	19-Nov-05	Strip marlin	Longline	18.39	158.13
HL1103	10-Nov-05	Big.thresher	Longline	19.42	156.08
HL1105	20-Nov-05	Big.thresher	Longline	18.42	158.17
HL1096	20-Nov-05	Scal. HH	Longline	18.42	158.12
HL1106	20-Nov-05	Scal. HH	Longline	18.42	158.16
A31291	20-Nov-05	Scal. HH	Longline	18.42	158.16

Appendix I

Calibration of the Simrad EK60 Echosounder
by Réka Domokos

Kealakekua Bay was chosen as an ideal site for the calibration of the 38kHz and 120kHz EK60 transducers because of its shallow, protected waters with no waves and minimal currents. Calibration of the EK60's transducers has been successfully carried out previously on two occasions in the same location. The calibration site within the bay was chosen as the same site used during the previous calibrations: an area of ~ 50 m deep water over a smooth, sandy bottom. Prior to commencing with the calibration, both the bow and stern anchors were deployed to maintain a stable position during the procedure.

The calibration involves the placement of a metal calibration sphere, with known acoustic characteristics, underneath the ship's hull-mounted transducers and recording the acoustic return from the sphere at positions that cover the entire circle of the transducers' beam. Since the 38kHz and 120kHz transducers are installed next to each other on a "pod" attached to the bottom of the ship's hull, the calibration recordings on the *Oscar Elton Sette* can be carried out once together for both frequencies. The position of the sphere is controlled by a three-reel electric system with monofilament lines leading from the reels to the sphere. The sphere can be centered below the transducers and below the ship by placing two reels on the port side and one reel on the starboard side of the ship.

The positioning of the calibration sphere within the transducers' beam took a minimal amount of time; once the sphere was attached to the three monofilament lines from the reels and lowered into the water to about 20 m deep, the sphere was within the transducers' beam. This was due to positioning the reels exactly as they were during the previous calibration and by following detailed instructions on the exact positions of the reels and the lengths of the monofilament lines to let out on each reel. NOAA-certified divers, who pulled the starboard side monofilament line over to the port side underneath the ship, were relieved at the time the calibration sphere was in position. Conditions in the bay during the calibration were not the most optimal because of the presence of a low amplitude inshore current within the bay. The movement of the water made it somewhat difficult to position the calibration sphere at certain near-edge locations within the transducer's beams. Moreover, two of the reels were malfunctioning and required constant manual assistance so that the lines could be let in and out by the electronic system. On one reel the axel that connects the motor with the reel was broken and needed replacement. In addition, the guide loops on the ends of the extension poles that guide the lines from the reels into the water needed to be replaced or equipped with freely rotating parts to accommodate the passing of the swivels on the lines that frequently got caught in the guide loops.

In addition, the computer that was used to obtain the EK60 readings crashed every time one calibration run was being completed, preventing the acquisition of the new calibrated settings for the transducers. Thus, the data recorded were saved on a CD to be used later to redo the calibration in the office to obtain the correct settings for the EK60 transducers.

Hearing Studies in Pelagic Fishes
by Rich Brill

Experiments to quantify the hearing abilities of juvenile yellowfin tuna were successfully conducted during the cruise. The procedure involved recording the brain response (formally called the "auditory evoked brain response," or "ABR") of fish to tone bursts of specific amplitude (loudness) and frequency. Data, obtained from seven animals, are still being analyzed but preliminary conclusions are that the effective hearing range of juvenile yellowfin is very narrow, extending from only about 300 Hz to 800 Hz. The fish appear to be the most sensitive to sounds in the 400–500 Hz range. The overall objective of the project is to determine if tunas could be attracted to sounds associated with fish aggregating devices (FADs) or use sound to locate distant FADs.

Report following the November 2005 *Oscar Elton Sette* Longline Research Cruise
by Gina Galli and Dr. Holly Shiels

An Investigation into the Thermal Sensitivity of Contractility and Excitation-contraction Coupling in Bigeye Tuna Cardiac Muscle

Project Overview:

The factors enabling bigeye and bluefin tuna to maintain cardiac function over large thermal gradients remain largely unknown. Preliminary work (by Prof. Brill on a previous research trip) has shown that ventricular strips from bigeye tuna defend contractile force in the face of temperature change to a far greater extent than other pelagic species: yellowfin tuna or mahi mahi. We propose that bigeye tuna recruit the sarcoplasmic reticulum (SR) to a greater extent at lower temperatures, and this allows them to sustain cardiac function while exploiting the colder foraging depths.

To test this hypothesis we used isolated cardiac muscle preparations from the ventricle and atria of the bigeye and yellowfin tuna and also the mahimahi. Muscle was exposed to a temperature gradient, mimicking the temperatures associated with a physiological dive. This experiment was then repeated in the presence of the SR inhibitors, ryanodine and thapsigargin. Additionally, cardiac myocytes were isolated from the heart tissue of bigeye, yellowfin, and mahimahi. The cells were transported back to the University of Manchester where confocal microscopy will be used to gather information on general morphmetrics and the presence of excitation-contraction coupling proteins.

Working at Sea:

There were several problems associated with testing this hypothesis aboard a research vessel. The main concern was with the rocking of the boat. Firstly, the weighing out of chemicals for ringer solutions and blocking agents was almost impossible on the vessel, as the balance could not stabilize with the rocking of the boat. This meant that all chemicals had to be pre-weighed on land. Secondly, muscle preparations were stretched because of the rocking motion, causing the elastic properties of the muscle to change throughout the experiment which led to alterations in the baseline level of tension. The movement of the boat also affected the ability of the isolated cells to adhere to the glass slides. Lastly, an obvious drawback to field research is the availability of fish, and as a consequence, we were limited in the number of animals we could experiment on.

Results to Date:

We are currently in the process of analyzing the data for these experiments, and as yet cannot give definitive answers to our questions. However, the general trends are as follows:

1) In all species studied, reducing temperature caused an initial increase in force, followed by a progressive decline.
2) In all species studied, reducing temperature below 10^{o} C resulted in a severe decrease in force or cessation of contraction.

3) In general, bigeye tuna cardiac muscle maintained higher contractile force at lower temperatures compared with yellowfin and mahimahi.
4) Application ryanodine and thapsigargin had little effect on yellowfin or mahimahi, while causing significant reductions in force in atrial muscle and modest reductions in ventricular muscle from the bigeye tuna.
5) Study of the characteristics of tuna and Mahi myocytes have not yet begun.

Future Plans:

Following these studies aboard the *Oscar Elton Sette*, Prof. Brill and Dr. Shiels have organized a further collaboration to investigate these theories more thoroughly. A grant proposal has been written to investigate the thermal sensitivity of bigeye tuna cardiac muscle at a number of organizational levels. This will include in vivo field studies, cellular and molecular investigations and is proposed to be in association with NMFS, NOAA, The University of Manchester, and the University of Hawaii.

Shark Dehooking Trials
Cruise Report

By Colleen Bass and Anik Clemens

Introduction

Section 305 (a)(9) of the Magnuson-Stevens Fishery Conservation and Management Act requires conservation and management measures to the extent practicable, minimize bycatch and to the extent bycatch is unavoidable, minimize the mortality of such bycatch. In compliance with this mandate, Hawaii-based longline fishing vessels are required to have on board dehooking devices for the safe release of incidentally caught sea turtles. This equipment has been demonstrated as being effective for increasing the post-hooking survival of sea turtles (Watson, 2004).

In the central and western Pacific, shark species are a major component of bycatch during commercial longline fishing operations and are often killed in order to retrieve hooks. When sharks are captured, fishermen either cut the line, leaving the hook embedded in the shark, or cut the flesh of the shark to retrieve the hook. Both options reduce the survivability of incidentally captured and released sharks. In general, fishermen retrieve longline gear quickly, often roughly handling and releasing bycatch. High muscular activity and stress induced by angling causes changes and disturbances in fish tissues and organs (Skomal and Chase, 1998). These changes manifest themselves in the blood, altering normal physiology and behavior in sharks that can ultimately lead to death. Dehooking equipment may provide a means to increase the post-hooking survivability of these ecologically important bycatch species. Sharks are subjected to extreme declines in population as a result of fishing pressures and low reproductive rates. The shark populations are less than 30 percent of the numbers they were two decades ago (Harvey). As the apex predator of the ocean, sharks are highly valued in maintaining an ecological balance. The high value for their fins, cartilage and liver oil in other countries[b] subjects populations to further decline. The objective of these trials is to evaluate whether dehooking equipment, used to minimize seabird mortality, would have applications for mitigating interactions with shark bycatch.

Methods

Shark dehooking trials were conducted on board the NOAA R/V *Oscar Elton Sette*. Over the course of 4 days (November 10-13, 2005), four shallow longline sets were made, abiding by current Federal longline fishing regulations. Sets 1, 2, and 4 were conducted 3-5 miles off the coast of Kailua-Kona, Hawaii (the Big Island), around Fishing Aggregation Devices (FADs). Set 3 was conducted off Jaeger Seamount, approximately 60 miles southwest of Kailua-Kona, Hawaii. The gear was set at night, at approximately 8:00 p.m. local time, and hauled back in the morning, at approximately 8:00 a.m. am local time. Approximately 450 hooks were set each night.

[b] The United States outlawed shark finning in 2000 with the “Shark Finning Prohibition Act” (Act) (Public Law 106-557).

Fishing Gear Specifications:

1) 18/0 circle hooks (15 hooks/float)
2) Float line length = 11m (approx. 6 fm)
3) Branch line length = 11m (approx. 6 fm)
4) Main line length = 10 km (approx. 6 miles)
5) Wire leader line length = 30.5 cm (12 in)
6) No weight attached to either branch line or leader line
7) Bait = saury (sanma)
8) 33 floats set (including 2 radio buoys)

Fishing gear was configured to simulate commercial fishing operations, however, on a smaller scale. Mainline length was 1/6 the length of a commercial fishing vessel; however, float line and branch line lengths were consistent with federal regulations, as well as the circle hooks and bait choice. The only deviation was the lack of a 10-degree offset in the circle hooks, which is required in the Hawaii longline fishery. The gear was configured for shallow set fishing, which targets swordfish.

Fishing operations were videotaped in order to show hook location once a shark was caught on the line. Video footage also captured dehooking trials in order to show successful versus unsuccessful attempts at dehooking sharks. Underwater video footage was taken during sets 1 and 3. Onboard video footage was taken during sets 2 and 4. Still photographs were taken during sets 1 through 4. Different media sources were used in order to obtain the best quality footage.

Experiment Equipment

1) Long handled dehooker (8 ft)
2) Dehooking data sheets (see attached for completed data sheet)
3) Canon XL2 video camera
4) Gates underwater housing for the XL2 video camera
5) 8 ft pole for Gates underwater housing
6) Panasonic video camera
7) Casio digital camera

The long handled dehooker is held by one person at the grips on the pole end. The branchline is held tightly by another crewmember. The dehooker is placed on the leader with the open end of the pigtail facing up. The dehooker is then pulled back towards you as with using a bow and arrow. Turning the pigtail end of the dehooker a ¼ turn clockwise puts the leader in the center of the curl giving the operator control of the line. The dehooker follows down the length of the leader until the pigtail engages the shank of the hook. A thrust downward with the dehooking device is an attempt at disengaging the hook. Figure 1 shows a sample of the long handled dehooker used in these trials.

Results

During the four shallow longline sets, sharks were predominantly caught. Of 33 fish caught, 22 were sharks. Other species caught and kept as specimens included mahimahi, escolar, snake mackerel, lancetfish, and swordfish.

When a shark was caught, it was determined whether or not dehooking could be attempted by the location of the hook. If the hook position was not visible, it was not possible to engage the dehooker; therefore no attempt to dehook the shark was made. However, if the insertion point was visible, such as in the side of the jaw, and the pigstail-end of the dehooker could be engaged at the shank of the hook, an attempt at dehooking was made. This method of dehooking requires a sharp jab of the pole downward against the shank of the hook. Each attempt to disengage the hook was considered a "trial" (see Table I). A trial was considered successful when the hook was retrieved from the shark with minimal damage, i.e., the hook exited the insertion point. Out of the 22 sharks captured, one was successfully dehooked. This attempt was successful, because the shark was hooked in the jaw *(maxillary)*, the dehooker was properly engaged, and the hooked was retrieved with minimal damage. Unsuccessful trials were because of the type of hook used, shark tissue, the height of the freeboard (the distance between the water line and the deck of the ship), the dehooking equipment, the stress caused to the shark, safety for the person using the dehooker, and the position of the hook insertion point (see Discussion Section).

Table I summarizes the information on sharks caught during the longline sets of these trials. The size of the shark is estimated as approximate length. A maximum of six trials were conducted for each dehooking attempt. No attempt was made for sharks with a hook position designated as unknown. If the trial was deemed successful it was designated as a 1. An unsuccessful trial was designated as a 0. No attempt at dehooking was also designated as a 0 because, in these cases, dehooking was also unsuccessful.

Table I.--Dehooking of shark species (four sets).

Shark species	Approx. length (ft)	Number of trials	Hook position	Success
Silky shark (*Carcharhinus falciformes)*	6	0	Unknown	0
Silky shark (*Carcharhinus falciformes)*	5	2	Jaw	0
Blue shark (*Prionace glauca*)	5	5	Jaw	0
Blue shark (*Prionace glauca*)	5	6	Jaw and Gill (2 hooks)	0
Bigeye Thresher shark (*Alopias superciliosus*)	5	5	Jaw	0
Blue shark (*Prionace glauca*)	5	0	Unknown	0
Blue shark (*Prionace glauca*)	5	5	Jaw	1
Silky shark (*Carcharhinus falciformes)*	5	2	Jaw	0
Blue shark (*Prionace glauca*)	6	0	Unknown	0
Blue shark (*Prionace glauca*)	4	0	Unknown	0
Blue shark (*Prionace glauca*)	6	0	Unknown	0
Blue shark (*Prionace glauca*)	4.5	0	Unknown	0

Shark species	**Approx. length (ft)**	**Number of trials**	**Hook position**	**Success**
Blue shark (*Prionace glauca*)	5	1	Jaw	0
Blue shark (*Prionace glauca*)	5	0	Unknown	0
Blue shark (*Prionace glauca*)	5	0	Unknown	0
Oceanic White-tip shark (*Carcharhinus longimanus*)	1	0	Jaw	0
Blue shark (*Prionace glauca*)	5	6	Jaw	0
Blue shark (*Prionace glauca*)	4.5	0	Unknown	0
Oceanic White-tip shark (*Carcharhinus longimanus*)	3	3	Jaw	0
Blue shark (*Prionace glauca*)	4	7	Jaw	0
Blue shark (*Prionace glauca*)	4	6	Jaw	0
Blue shark (*Prionace glauca*)	5	4	Jaw	0
				1
			Dehooking success rate of attempted trials= 1/11 Dehooking success rate of all sharks hooked = 1/22	

A number of problems were encountered during the dehooking trials. These issues are organized into seven categories: the type of hook used in the trials, shark tissue, the height of the freeboard, the dehooking equipment, the stress caused to the shark, safety issues for the user of the dehooker, and the position of the hook insertion point.

1) Type of hook: Circle hooks are difficult to remove because of their design. They are configured to hook in the maxillary of the fish and remain strongly intact in the sharks flesh. The curved shape keeps the hook from being embodied in the gut cavity or throat. The benefit of a circle hook is that it is less likely for the animal to be hooked internally. Internally hooked animals incur more damage to vital organs than those hooked in the maxillary. Hence the survival rate is higher for those hooked in the maxillary compared to those hooked internally. Circle hooks are required hooks for shallow-set fishing operations. Tuna hooks are designed to be removed more easily. These are the primary hooks used in deep-set fishing operations. A diagram of the 18/0 circle hook used in this experiment is shown in Figure 1.

2) Shark tissue: The tough skin oral cartilage of sharks contributes to the difficulty of removing the hook, especially without causing more damage to the shark. Most trials did not protect the shark from further tissue damage.

3) Height of freeboard: The height of the freeboard and longline operations area on the NOAA ship *Oscar Elton Sette* is much higher than on a typical Hawaii longline vessel. The 8-ft pole of the dehooker was barely long enough to engage the shank of the hook while providing enough leverage to disengage the hook. Increasing the length of the pole itself would be counterproductive because control of the dehooker would be reduced. The one successful dehooking trial was conducted while the operator was on his knees

thereby increasing leverage to dehook the shark. A tether was connected to the dehooker in order to prevent the dehooker from going overboard.

4) Dehooker equipment: The dehooker pole bent under the weight of the shark. The two pieces of the dehooker also detached under the weight and movement of the shark. Electrical tape was used to reinforce the two adjoining pieces of the dehooker.

5) Stress on shark: The physiological effects brought upon the sharks during dehooking trials could pose more stress on the fish than leaving the hooks in place. The economic benefit of retrieving the hooks by dehooking versus survivorship of shark bycatch should be further evaluated. The physiological effects of stress on sharks from dehooking are unknown at this time.

6) Safety issues: Crewmembers on the NOAA ship *Oscar Elton Sette* were at more risk of falling overboard than on a commercial longline vessel because of the height of the freeboard.

7) Insertion point of the hook: If the hook's insertion point was not visible, the dehooker could not be engaged. The dehooker proved ineffective in circumstances where the hook had been swallowed or in any case where it was not visible.

Technical difficulties were also encountered in the filming of the dehooking trials using the underwater video camera. The pole for the camera was the same length as the dehooking pole (8 ft), and therefore posed similar issues to those encountered with the dehooker pole. The height of freeboard, the length of the pole, and the safety of crewmembers all contributed to the difficult task of keeping the camera steady during the filming process. Being able to completely submerge the camera in the water while keeping the focus steady on the object in the viewfinder was not possible onboard the NOAA Ship *Oscar Elton Sette*.

Discussion and Conclusion

Dehooking equipment did not successfully release shark bycatch with minimal injury. The combination of circle hooks, the toughness of the shark's skin where the shark was hooked, and the layout of the vessel all contributed to failed attempts at dehooking sharks. These trials demonstrated that under a modified design dehooking gear could be successful in releasing sharks with minimal injury. The underwater video equipment could be more useful if used on board a commercial longline vessel, with less freeboard, and the camera be submerged for longer periods of time. Therefore, the problems encountered during these dehooking trials should be further evaluated and protocols revised.

Recommendations

It is recommended that future studies be conducted comparing the success rate of dehooking shark species using tuna hooks versus using circle hooks. Tuna hooks may have a higher success rate in dehooking fish, therefore a higher survival rate in shark species. Such a study should be conducted onboard a commercial longline fishing vessel.

Studies should also be conducted to determine whether dehooking equipment could increase the survivability of other bycatch species. Fishermen kill many non-target, undesirable fish (such as pelagic stingrays, oilfish, snake mackerels, etc…) that could potentially be released with minimal injury by using the proper equipment. Many hooks are lost every year because fishermen cut the line on fish species they discard. Dehooking bycatch would enable fishermen to retrieve more hooks, thereby saving money, and also increase the survivorship of bycatch fish.

High-frequency Acoustic Recording Package

by Chris Garsha

On November 17, 2005, during *Oscar Elton Sette* cruise OES-05-14, the HARP (High-frequency Acoustic Recording Package) was successfully recovered at Cross Seamount. The instrument was initially deployed by Scripps Institution of Oceanography (SIO) technician, Allan Sauter, on April 26, 2005. The HARP was deployed at the exact position of latitude 8° 43.325N, longitude 158° 15.230W at a depth of 390 meters. The instrument recorded during the period of April-November 2005 at a sample rate of 200 kHz. In order to extend the recording period, given the storage capacity of 1.2 Tbytes, the instrument sampled using a duty cycle of 5 min every 25 min. The instrument was then refurbished to be redeployed in the same vicinity. New hard drives, batteries, and ballast weights were outfitted to the instrument and redeployment was achieved on November 18, 2005. The new position of operation was at latitude18° 43.343N, longitude 158° 15.221W at a depth of 396 meters. As in the previous deployment, the instrument was set to sample at 200 kHz utilizing a duty cycle of 5 min every 25 min.

Initial analysis of data, primarily in the field, indicates good system performance and successful acoustic sampling. Further analysis at the SIO Laboratory in La Jolla, California will be necessary to properly evaluate the system and process the data. The objective of the project is to collect and analyze broadband acoustic data on false killer whales. Acoustic recordings provide an efficient means to monitor for the presence of marine mammals. The ultimate goal is to develop techniques for acoustic census of false killer whales and other marine mammals.